Electronic Modeling and Design for Extreme Temperatures, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

We propose to develop electronics for operation at temperatures that range from -230

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C to +130

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C. This new technology will minimize the requirements for external heat sources that are currently necessary for operation of low-temperature electronics. Such technology would significantly improve reliability, performance, lifetime of electronics that are used for space applications, including satellites and space travel. This will be achieved through the development of unique circuits that are derived from novel physics based device and circuit modeling techniques and verified by experiment. Statistical methods will be employed to connect the resistive heating caused by individual devices to heating of the entire integrated circuit. Special algorithms will be further developed which allow for determination of operating conditions where the intrinsic operation of the circuit will allow for sufficient heat generation to eliminate carrier freeze-out and efficient operation of integrated circuits in environments ranging from -230

o

C to +130

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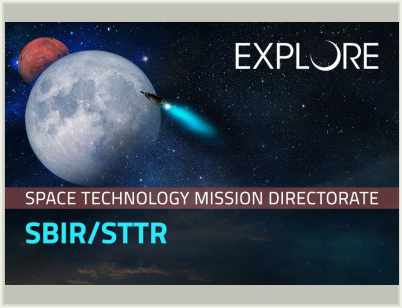
C. For situations where intrinsic circuit resistive heating at cryogenic temperatures is insufficient to overcome carrier freeze out, we will design on-chip micro-heaters to provide direct heating to chips at the submicron device level. Thermal modeling of packaging will also be performed. With the intrinsic temperature control established, we will design specific single electron latchup immune circuits for application extreme environments.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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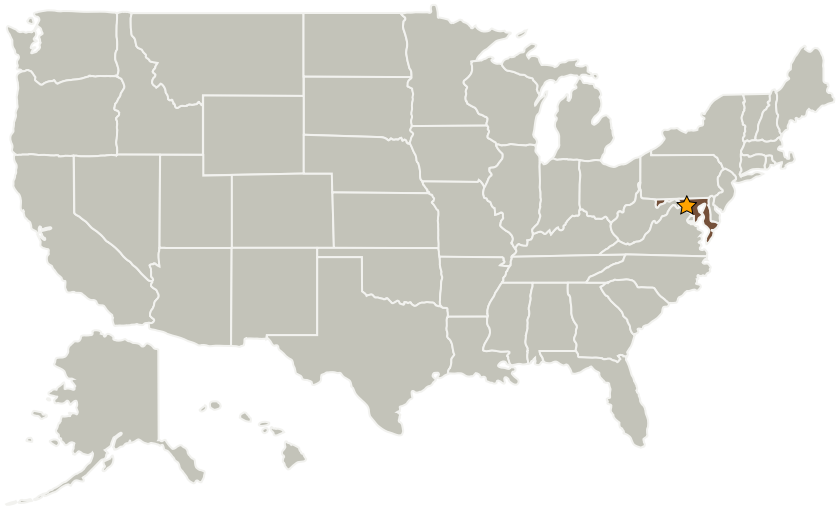
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
CoolCAD Electronics, LLC	Supporting Organization	Industry	Takoma Park, Maryland

Primary U.S. Work Locations
Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.3 Avionics Tools, Models, and Analysis
    - TX02.3.1 Electronics Development Tools